METHOD AND APPARATUS FOR MAPPING A INPUT LOCATION WITH A DISPLAYED FUNCTIONAL REPRESENTATION

This invention is a continuation in part to U.S. Application 09/607717.

FIELD OF INVENTION

This invention relates to providing a graphical user interface, and more particularly to providing input selection through an input device that has localized lighting near pressure actuated input surfaces.

BACKGROUND OF THE INVENTION

Program control of a CPU, e.g. a in personal computer, is frequently driven by user inputs via a keyboard or other discrete input device. A key, sometimes called a button, or keypad, often has a preprinted number, letter or symbol appearing on it. This provides a user with an understanding of a function that the key is generally supposed to trigger.

A function of a key may vary according to the state of the CPU, also known as the context of the CPU. For example, pushing a key denoted as 'Caps Lock' on its surface, will trigger a toggling of a QWERTY keyboard between lower-case and upper-case keyboard input. Similarly, use of the 'function' key or 'control' key on modern personal computers causes keys to take on a myriad of functional abilities, depending on the program operating on the Personal Computer or PC.

In some cases of controlling a CPU, it is unnecessary to mark a key with any symbolic notation to indicate its purpose. This is most evident in many Automated Teller Machines (ATM). In such cases, the buttons are located adjacent to the display area such that when text appears adjacent to a given button, it is obvious, due to the proximity of the text to the button, what is the intended functionality of that button upon actuation. ATMs naturally, are very specific purpose machines, and so the arrangement of text to describe button functions varies according to a very predictable and limited program.

The category of hyperlink includes functional text, i.e. hypertext, or functional graphics. Each hyperlink has an associated function or hyperlink function. A hyperlink function may cause any change in the output or storage of any device operatively coupled to the CPU of the browser device. Hypertext is commonly used with the World Wide Web (WWW). Unlike ATMs, a functional text, or a graphic as found on the WWW, may appear anywhere on a display, and is seldom restricted to orderly columns or rows of presentation. More importantly, in a desktop

environment, keys are so far from the display, that even if functional text or graphics were located at the periphery of the display, an average user might find it difficult to see a correlation between keys on a PC keyboard and displayed text or graphics.

Fortunately, many techniques for using pointing devices remove the need for such an arrangement. Even before mice were available, menus provided similar ability to call on functions. A menu, or submenu item, would have a precursor number, or letter, set apart from, or highlight within, functional text. A typical menu, once displayed, is operated in tandem with a input routine that permits a selection upon the occurrence of a single keystroke, wherein the selected function is denoted by the functional text of the menu item, and the operating key, by a single highlighted symbol therein.

The use of hypertext has become so advanced that today, routinely, hypertext is created in Hyper Text Markup Language (HTML), Wireless Markup Language (WML) and other markup languages such that displayed text, may operate as a doorway to additional functions by simply moving a cursor to the displayed text and clicking on it. Among the many features of HTML, when read by a compatible browser, is the ability to give hypertext a color of its own, to separate the text from non-functional text, and otherwise provide a pleasing color combination with other parts of a HTML page. The ability to specify the color of a link, within the HTML file, is done for aesthetic reasons so as to maintain a consistent theme through a family of HTML pages.

Among the features of WML, when read by a compatible browser, is the ability to identify a key, usually by the insignia printed on the key, that will operate to trigger the hyperlink associated with an anchor, see e.g. Wireless Application Protocol Wireless Markup Language Specification Version 1.3, © Wireless Application Protocol Forum, Ltd. 2000. Therein is specified as well, other input means including the select element, the option element and the input element. Unfortunately, for the WML language and others like it, there persists the need to highlight or otherwise correlate (sometimes with additional text) a hyperlink (or other input element) with symbols in use on common keyboards, or other character entry devices. Because of the scarcity of display real estate in many mobile devices, use of fewer pixels showing keypad controls provides an opportunity to squeeze a bit more data into the display.

In a situation of handheld computers, sometimes embedded in mobile stations, such as mobile phones, the ATM-like keys are known as soft-keys. Like the ATM, the soft-keys are mounted very close to a display surface, e.g. about 1/4 inch. In contrast to a typical laptop -- the nearest keys on an IBM® ThinkPad are about 1

1/4 inch away from a display surface. Even though the mobile station has a minimal distance, many people are unable to make the connection between the softkey and the intended function displayed nearby. In such instances, much of the functionality of the mobile phone is hidden from the person using the phone.

Because a mobile station is used frequently as a personal communication device, it has versatility not present in wired phones. Consequently, the mobile station has been designed for use in all manner of conditions, including darkness. Thus the keypads are often designed to illuminate from within when entries are being made. Because the purpose has been to improve visibility of keys, the lighting is usually uniform to all keys, and has been monochromatic.

Since a hand-held unit, and in particular a mobile phone, must devote space for a 12-key keypad, the room allowed for a display is frequently small, e.g. about 5-6 lines of text. Although a mouse of diminutive proportions could be added using a J-key sensor, fine cursor movement through such a small screen would yield markedly diminished results as compared to use with desktop sized monitors. None-the-less, requiring a user to use a cursor advance function, such as employed by the use of the 'tab' key in the popular text browser, LYNX, is inefficient, particularly as the operable choices start to exceed four. This becomes more taxing on the user of a device when a keypad has key-sizes less than a quarter of the area of the DIN-standard form factor of computer keyboards.

Hence, a need exists for a selection method and apparatus to reduce repetitive keystrokes on hand-held devices that provide hyperlinks visible on a display. A need exists to form a visible link between a key on a keypad and a hyperlink on a screen without crowding keys around the display. An ability to obtain greater functionality from a standard key layout is also needed.

SUMMARY OF THE INVENTION

The present invention provides a method and apparatus for selecting a function in an input device. A first function is displayed as a first depiction highlighted using a first color. A second function is displayed as a second hyperlink depiction highlighted using a second color. A color selection is made from among the first color and second colors, which is detected by, e.g. a CPU. The CPU branches program execution to select a function based on the color selection.

An embodiment of the invention may read a hypertext file or list, and assign colors to hyperlinks that are visible in the physical display of a device. Color assignment may override any color assignment in the native HTML for a hyperlink so that each hyperlink that points to a unique function has a unique color assigned to it,

yet the hyperlink is depicted with a color that matches at least one key of a keypad. Also, assignment of color may be utilized in the creation of a data structure, e.g. a lookup table, indexed by color, and matching a function. Upon the selection of a color, the matching function is triggered by a CPU.

Another embodiment of the invention may receive a request to read a hypertext deck. The embodiment may disable lighting to at least one key. Then it reads the hypertext deck having distinct keys associated with each hyperlink. For each key that is identified as actively associated with a link specified in the deck, the embodiment may light the key associated with the link. An advantage provided by one or more embodiments of the invention is that highlighted portions of a display, and any corresponding function, may be selected by inputting a unique color associated with the function. This may be done with a single keystroke, even though there may be many choices visible on the screen.

Among the many advantages of the present invention, one or more of the disclosed embodiments provides that each button of a handheld device may have a unique color, which matches a function listed on the display. Anyone who perceives color can select a function from the keypad that matches the display.

Another advantage provided by one or more embodiments is that on a device controllable chiefly with buttons, a method is provided that permits selection of any listed item with a single keystroke, without the need to find a matching symbol to the listed item on a button. This is true even though there may be many listed items or hyperlinks.

Another advantage provided by one or more embodiments is that recognition of a linkage between a button and a displayed function is improved so that people who are illiterate may still see the connection between a distant button and a displayed hyperlink depiction having a color in common with the button. Moreover, persons with moderate sight impairment may better locate buttons having color from edge-to-edge, than locate one of several characters that appear on a button face.

Another advantage provided by one or more embodiments is that there is no difficulty reading button colors, even though a device may be oriented upside down, with respect to characters printed on buttons.

Another advantage provided by one or more embodiments is that the display, though it may be too full of links to see a positional correlation with nearby buttons, is still close enough to the buttons, that the button colors may be seen with peripheral vision. This permits a button selection that is accurate in terms of selecting the matching hyperlink depiction -- while never glancing away from the display.

Still another advantage of an embodiment may offset the fact that a key's

function may be implicit in its location, or hinted at by the displayed name of a link. To reduce the ambiguity relating which among many keys will be active in relation to a displayed link or other markup language tag, only keys that are tied to a markup language tags of the deck may be illuminated, e.g. by LEDs from below.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosed inventions will be described with reference to the accompanying drawings, which show important sample embodiments of the invention, wherein:

Fig. 1a is a representation of a formatted hyperlink file as it would appear if displayed to a screen having large dimensions;

Fig. 1b is a representation of a viewable window superimposed on a virtual screen, wherein the virtual screen is larger in all dimensions than the viewable window;

Fig. 2 is a block diagram of a mobile station embodiment of the invention;

Fig. 3 is a flow chart of the steps performed by an embodiment of the invention;

Fig. 4a shows an example of some hyperlinks in a virtual screen;

Fig. 4b shows a view of some of a data structure that may hold the location information of the hyperlinks; and

Fig. 5 shows the configuration of a keypad in relation to a display; and

Fig. 6 shows an example of a markup language deck used as an instruction to illuminate some of the keys.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The numerous innovative teachings of the present application will be described with particular reference to the presently preferred embodiment. However, it should be understood that this class of embodiments provides only a few examples of the many advantageous uses of the innovative teachings herein. In general, statements made in the specification of the present application do not necessarily delimit any of the various claimed inventions. Moreover, some statements may apply to some inventive features but not to others.

Fig. 1a shows a representation of a formatted hyperlink file as it would appear if displayed to a screen having large dimensions. Since most formatted hyperlink files -- such as would be produced by a conventional desktop browser on a html file -- are suited for 'fat' browser capability, very frequently, a display on a mobile station is unable to show the entirety of the formatted hyperlink file. Under such

circumstances, a mobile station may provide a 'scrolling' capability similar in effect to the scrolling performed on a conventional html page when it is not visible in the display area of a computer display. The excess formatted hyperlink file is called a virtual screen **100**. The area of the virtual screen **100** that may be seen in the display of a device, such as, e.g. a mobile station, is called the viewable window **101**. Fig. 1b shows a viewable window **111** that is so small that the excess of the virtual screen **110** extends beyond the left **112** and right edges **113** as well as the top **114** and bottom **115** edges of the viewable window.

The formatted hyperlink file, is more than raw hypertext, it is a representation, in the order and orientation, of text and graphics, that an author intended the file to have when viewed by human eyes. The formatted hyperlink file has a number of functional areas, which are often visible with specialized cues. As an example, Hyper Text Markup Language (HTML) authors frequently use the default specialized cue of an underscore and blue coloring to identify functional area relating to some text. When presented by a browser using conventional HTML, an image can have a specialized cue, sometimes denoted by a blue border. In a general sense, these specialized cues are a highlight to the functional area, and have virtually always been a uniform color for a given formatted hyperlink file. A formatted hyperlink file may be a filtered version of HTML, such as produced by a Web Clipping Application (WCA). A formatted hyperlink file may be very short and includes lists of functions displayed in a column.

Fig. 2 shows the hardware of a typical mobile station. The mobile station may be a mobile phone. The mobile station may be a personal digital assistant. An antenna **201** may be used to receive signals and transmit signals. Transceiver **203** may provide the ability to convert signals from analog to a digital baseband signal and from a digital baseband signal to analog. Processor or CPU **215** may receive data from the transceiver **203** and provide such data as analog or digital signals to output devices. An audio output or audio renderer **205** provides a sound output. Audio output **205** may take its input in analog or digital form from the processor **215**. Processor may provide output to a display **207**. The display **207** may be a LCD, LED a raster scanning device among others. Processor **215** may rely on storage **209** for occasional storage and retrieval of data. Such data may include information providing a context of a state machine, or other program. Such data may include audio or visual data in compressed or uncompressed formats.

Fig. 2 also shows some input devices. An actuating means **211** may include a device capable of detecting inputs along a two-dimensional plane, including keypads, touch-pads, graphic tablets and mice. Inputs may be converted to a digital signal

and fed to the processor **215** for action in accordance with program control. In some cases, a input means may be overlaid over, or interspersed with some display elements, or illuminating means. Microphone **213** may provide voice control inputs to the processor **215**. Microphone may provide a communication signal to the transceiver **203**. Transceiver **203** may provide analog to digital conversion of voice signals from the microphone **213**.

An embodiment of the invention, executing on a mobile station, performs the steps of Fig. 3. A formatted hyperlink file is obtained **301**, either through a communications port, from another process or from local storage. A CPU on the browsing device parses **302** the formatted hyperlink file. A determination may be made at each delimiter, to see if a string of the formatted hyperlink file is a hyperlink **303**. Such a method of determination is well known in the art. If the string is a hyperlink, then a determination is made of the position the link would appear in on a two-dimensional virtual screen **305**. Such a position may be stored in a data structure, e.g. a list, having storage of the hyperlink string, a horizontal or x position, a vertical or y position. The steps of parsing, and list storing **305** may be executed iteratively until a end of file is detected **307**.

The list may be sorted **309** left to right for each row, and then arranged so that hyperlinks in rows positioned at larger 'y' positions are closer to the end of the list than hyperlinks in rows at smaller 'y' positions. The sorting of the sort step **309** may be in an order consistent with the way text is read by a person who reads from left to right. Sorting may also be consistent with an input device order. The input device order may be based on the arrangement of the actuating means, e.g. the order of keys 1 through 0 on a 12-button keypad in common use on telephones. A viewable window may be smaller than the virtual screen. In that case, a sub-list is created **313**, wherein the sub-list organizes the visible hyperlinks depictions, i.e. the hyperlinks depictions appearing, at least in part, within the viewable window. A test may be made to determine if a hyperlink depiction appearing in the sub-list has an assigned color **317**, that is a color selected by the CPU that overrides any color native to the formatted hyperlink file. A keypad color may be selected **319** that is among a set of keypad colors that are not assigned. Some hyperlinks may no longer be visible on the viewable window following input by a user to scroll the display. In that case the color assigned to the hyperlink may be added to a list of unallocated colors. The CPU controls the display to provide a color highlight **323** at the visible hyperlink. The visible hyperlink is a hyperlink depiction, and the arrangement of two or more hyperlink depictions on the viewable window is the depiction order. Such a color highlight may be controlled by modifying the formatted hyperlink file to embed a

color tag to be associated with the hyperlink, wherein the color tag is interpreted by a browser program as a color similar to a keypad color. Alternatively, if a color tag already exists for the applicable hyperlink, the existing color tag may be modified to become a color similar to the keypad color. A color highlight may be at a hyperlink depiction when the color a) fills the hyperlink depiction; b) surrounds the hyperlink depiction; or c) is a continuous streak extending the substantial length of the hyperlink depiction, and nearby to the hyperlink depiction.

Once the keypad colors have been allocated to all hyperlinks on the viewable window, the browser device may enter a loop to obtain input **325**, wherein it may poll circuits controlled by keypad keys having similar colors to the color of visible hyperlinks in order to detect a keypress. When such a keypad is pressed, a pressed keypad color or selected color is determined. The CPU may detect the selected color. The pressed keypad color may operate as an index to lookup an associated hyperlink. Alternatively, the pressed keypad color may operate as an index to lookup an associated hyperlink functional. Execution **329** by the browser device then operates according to the hyperlink function of the associated hyperlink by means well known in the art. Any color allocations may be reallocated at this time.

Fig. 3a shows an example of some hyperlinks in a virtual screen **401**. A viewable window **403** occupies the midsection of the virtual screen **401**. Link D **411** is located at coordinates (1,5). Link D **411**, Link E **412**, Link F **413** and Link G **414** are all visible within the viewable window **403**.

Fig. **4**b shows a view of some of a data structure that may hold the location information of the hyperlinks **451**. Coordinate information **452** may be included, using the row and column of the link. A button label **453** and color association **454** pair may be associated dynamically to a hyperlink name **451**. Associations for the current viewable window show the association **476** of link D **456** with color red **466**. An association **477** of link E **457** may be made with color yellow **467**. An association **478** of link F **458** may be made with color green **468**. An association **479** of link G **459** may be made with color light purple **469**. Such associations and lists may be made using tables, pointers, or other means known in the art. Other data may be included in the data structure. Following selection of colors by step **319** of Fig. **3**, associations are made between each hyperlink visible within the viewable window and a color assigned to a keypad button.

The operation of the flowchart of Fig. **3** suggests that a color highlighting assignment to a bit of text or graphics may persist as a user scrolls a viewable window up and down. An alternative embodiment may reallocate colors based on the position or zone that a hyperlink moves to following a scroll operation. A zone

may be a row of characters. Such a zone approach would entail reassigning a color of a hyperlink as the hyperlink rises in the viewable window, i.e. while the link is in the lower quarter of the window, assign a color of the lowermost row of buttons, which includes light blue **499**. The next higher quarter of the screen, may then have links highlighted with colors selected among the colors of the '7', '8' and '9' buttons. Rising still further into the third highest quarter of the screen, colors associated with the '4', '5', and '6' buttons might be used. And finally, when a hyperlink is scrolled to the highest part of the viewable window, colors associated with the '1', '2' and '3' buttons may be used. A shift from one zone to the next, would entail providing a new color hyperlink depiction, and re-mapping the button that is associated with the function of the hyperlink.

Fig. 5 shows the display area **501** in combination with a keypad input device **503** of a mobile station. In the display area **501** which shows a viewable window of an associated file, are four hypertext links: one that triggers display of information concerning "wireless future" **511**; one that triggers display of information concerning "Menzies J Mode" **512**; one that triggers display of information concerning "Commercial Sites" **513**; and one that triggers display of information concerning "Yahoo! And others" **514**, wherein each of the hypertext links color match: the one key **521**; the two key **522**; the three key **523** and the four key **524**, respectively. Each key of the keypad may be large enough to fall within the peripheral vision of a user. The peripheral range **550** is the angular distance from the direction of view wherein a user may gaze directly at the display area **501** and be able to select a colored button of sufficient size according to the color desired -- without the need to adjust gaze. The range, naturally, may be larger for a colored button that has a larger size, as compared to a button of smaller size. The peripheral range may vary from user to user and may be measured while the display and buttons are at a distance from an eye that is typical of a user holding the device containing the display and buttons.

In an embodiment of the invention, a browser device has color-coded keypad, wherein the occurrence of a key-press or a key release may be detectable at a CPU. The color code may be on the key or button, or in an adjacent area to the key or button.

An alternative embodiment would provide lighting to each keypad button such that a color of the button may be selected. The color may be selected by a CPU by closing a circuit to one or more different colored LEDs positioned near a keypad button. A combination of at least one light source positioned close enough to a button so as to light that button without significant illumination lighting nearby buttons is known as a button-light pairing.

Fig. 6 shows a markup language file bearing a wireless markup language (WML) tag **601** upon which an embodiment of the invention operates. The text "hello world" **603** is not active and has no navigation function associated with it. The following tag **605** carries display context **607**, input field rendering instructions **606** and a coupling of the foregoing to a character-entry pressure-point, e.g. a button, **609** in the form of *accesskey="1"*. The number in quotes, 1, is a reference to a character encoding. Such a reference could be to an alphabetical character, punctuation, or any other character that is commonly printed on or near a device button. The field has a navigation function associated with it, namely, that if the navigation function is selected, e.g. by pushing a button having the character encoding, a next keystroke will be added to the field. In this case, a CPU reading the file, associates a keystroke of a button marked with the character encoding 1, and awaits the next keystroke signal from the keypad. When a key-press of the button occurs, the CPU detects the key-press. The CPU may by means known in the art, move a cursor, or perform other navigational functions, including changing at least one pixel on the display. Each such navigational function may be associated with the markup language that appears in the rendering instructions **606**. Reading this rendering instruction causes the CPU to illuminate the button via, e.g. a button-light pairing applying current to the circuit supplying light to the button marked 1.

Similarly, the rendering instruction **616** in the second input tag **615** provides a second display context **617**, and an associated button **619** in the form of *accesskey="0"*, thus associating a key-press of the button having the character encoding of 0 printed on or near with a second input field. Reading this rendering instruction causes the CPU to illuminate the button via, e.g. a button-light pairing applying current to the circuit supplying light to the button marked 0.

Finally, the rendering instruction **627** in the hyperlink anchor tag **625** provides a navigational function *href="random/random.wml"* **626**. Associated with the navigational function is the encoded character 9, which appears in button reference **629**. A display context **627** may be displayed on a display. Reading this rendering instruction causes the CPU to illuminate the button via, e.g. a button-light pairing applying current to the circuit supplying light to the button marked 9.

Upon reading each association of a button appearing in the first input field **606,** second input field **616,** and the hyperlink anchor tag **626**, the CPU illuminates the 1, 0 and 9 buttons respectively. Cursor movement, movement between cards in a deck and other navigational functions may be selected upon detecting a key-press of a button, i.e. a cursor may be positioned on the display responsive to a key-press. Upon detecting application of pressure to a character-entry pressure point, e.g. a

key-press of the button having a '1' marking, the CPU performs the navigation function associated therewith.

Detection of a key-press may result in changing at least one pixel of the display to reflect the navigation as influenced, e.g. by cursor movement, or by rendering of another card.

Note that although a button is suggested as a possible character-entry pressure point, other suitable character entry devices that rely on pressure may be used instead. Other character-entry pressure points, i.e. devices that actuate based on a pressure, include but are not limited to, roller keys, touch screens and the like. Illumination of such active character-entry pressure points may be such that the input surface on or around which the character appears is illuminated from behind, the side or any other direction.

Although the invention has been described in the context of particular embodiments, it will be realized that a number of modifications to these teachings may occur to one skilled in the art. The embodiments may operate within a number of different packages, e.g. a mobile phone, pager, or electronic organizer. A number of input devices could be used to detect color inputs, including any device that detects finger placement, or the coordinates of a stylus tip. Thus, while the invention has been particularly shown and described with respect to specific embodiments thereof, it will be understood by those skilled in the art that changes in form and configuration may be made therein without departing from the scope and spirit of the invention.